How representation, relationships, and community act as ‘social vaccines’ for underrepresented students in STEM

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Core social motives drive human behavior

• Humans are a social species that rely on relationships to survive and thrive. A few social motivations drive human thinking, feeling, and behavior.

• **Need to belong:** We gravitate toward social environments where we feel we belong and away from others where we feel like misfits.

• **Need to feel competent and worthy:** We pursue activities that make us feel confident and worthy and move away from others that make us doubt competence and worthiness.

• These motivations guide human behavior in many situations including our academic and professional choices.
Yet impact of social motives on STEM pathways is underestimated

- We assume that talent and ability is all that is needed for and success in STEM.
- We assume high performance in STEM disciplines is the best predictor of persistence and success.
- We assume that young people who leave STEM pathways must be struggling in terms of performance.
Contrary to assumptions, research shows...

- People who are talented in STEM may initially approach STEM activities, but persistence depends on whether learning environment satisfies core social motives.

- High performance is not sufficient for persistence if students’ need to belong and to feel competent are not satisfied.

- For people underrepresented in STEM, approaching STEM spaces activates negative stereotypes.

- These stereotypes plus scarcity of similar others threaten feelings of belonging and confidence, making young people move away from STEM pathways.
Stereotype inoculation model and ‘social vaccines’

Dasgupta (2011), Psychological Inquiry
Two evidence-based solutions that satisfy social motives in STEM

Mentoring relationships with own-group peers

Learning community based on common identity
RELATIONSHIPS

Same-sex peer mentors as social vaccines
Peer mentors in the transition to college

Longitudinal study with first-year women in engineering ($N = 150$).

Random assignment to condition: female mentor, male mentor, or no mentor (control)

Mentor-mentees met for 1 year.

Tracked mentees’ progress from 1st year through graduation long after mentoring had ended.
Belonging and confidence in engineering: 1st year of college

Women’s retention in engineering majors: end of 1st year of college

Dennehy & Dasgupta (2017). PNAS
Four years later at college graduation (Peer mentoring has long ended)

Wu, Thiem, & Dasgupta (2021)
% Success securing engineering internships

\[ \chi^2(1) = 4.79, p = .029. \text{ Wu, Thiem, & Dasgupta (2021)} \]
% Women graduating with engineering majors

Wu, Thiem, & Dasgupta (2021)
% Women graduating with STEM majors

Wu, Thiem, & Dasgupta (2021)
COMMUNITY

Living-learning community for first-generation students in STEM
Living learning community in biological sciences

Recruited first-generation college students in first year of college.

Randomly assigned to living learning community vs. control condition

Race & ethnicity: 27% Black, 12% Latinx, 21% Asian, 36% White, 4% other race/ethnicity.

Sex: 69% female, 31% male.
Features of the living learning community

Living learning group: Many bonding opportunities for first-gens
• Took introductory biology as a cohort.
• First-gen peer mentor
• Students’ roommate was also in the living learning group.
• Community building socials with first-gens

Comparison group (controls)
• Intro biology w/ non-first-gen students
• First-year seminar with non-first-gen students
• No peer mentor
• Roommate not matched by major or first-gen status.
• No community building socials with first-gens
Belonging, anxiety, mindset, & grades

Wu, Gibson, & Dasgupta (2021).

**Belonging**

- Control: 4.5
- Living learning: 5.5

\[ d = .62 \]

**Anxiety & Worry**

- Control: 4
- Living learning: 3.5

\[ d = .42 \]

**Growth Mindset**

- Control: 4
- Living learning: 4.5

\[ d = .36 \]

**Grade in Biology**

- Control: 3.2
- Living learning: 3.8

\[ d = .68 \]

Wu, Gibson, & Dasgupta (2021).
Living learning community predicts better grades through reduced anxiety.

Hayes’ PROCESS Model 4 with 5,000 bootstrapping samples

Indirect effect: $B = 0.07$, $SE = 0.04$, 95% CI [.01, .18]

* $p < .05$; ** $p < .01$
The take-away

• Low cost programs that foster relationships and community with similar others act as social vaccines allowing young people to thrive in STEM.

• Focus on fixing learning environments, not fixing students.

• These programs work because they satisfy students’ need to belong and need to feel competent.

• These psychological indicators are more powerful predictors of student persistence more so than performance.

• The “sweet spot” for these programs are during transition periods in life when young people find themselves in new unfamiliar environments.
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